3.0 ALTERNATIVES

In considering Gulf LNG's applications, the FERC will review both the environmental and non-environmental record in deciding whether it is in the public convenience and necessity to issue an authorization for the project. The EIS addresses alternatives to the proposed actions before both the FERC and the Coast Guard.

The FERC must consider whether or not to approve the facilities proposed by Gulf LNG and to allow operation of the facilities. The proposed action before the Coast Guard, as required by their regulations in 33 CFR 127.009, is to consider whether or not to issue Gulf LNG an LOR that finds the waterways suitable for LNG marine traffic with conditions. The Coast Guard, with input from the Pascagoula AMSC, has completed an initial review of Gulf LNG's WSA in accordance with the guidance in Coast Guard NVIC 05-05. The WSA review focused on the navigation safety and maritime security risks posed by LNG marine traffic, and the measures needed to responsibly manage these security risks. The WSA itself is designated Sensitive Security Information as defined in 49 CFR Part 1520. Because any unauthorized disclosure of these details could be employed to circumvent the proposed security measures, they are not releasable to the public.

As a result of this review, the Coast Guard advised the FERC in its WSR letter dated March 7, 2006, that the Pascagoula Bar, Horn Island Pass, Lower Pascagoula, and Bayou Casotte Channels can accommodate the LNG marine traffic associated with the project. The letter stated that there is sufficient capability within the port community to responsibly manage the safety and security risks of this project. In a follow-up letter to the FERC dated September 5, 2006, the Coast Guard clarified that the March 7, 2006 letter gave a preliminary evaluation to meet the recommendations of NVIC 05-05. The September 5 letter also stated that any final determination of waterway suitability is contingent upon an evaluation of certain conditions, including those identified in section 2.0. With the completion of this final EIS, the Coast Guard will complete its review and issue an LOR to address the suitability of the waterways for LNG transport.

A typical LOR would address the suitability of navigation channels in the Port of Pascagoula for LNG ship transportation, it would not constitute a final authority to commence LNG operations. Issues related to the public impact of safety and security zones would be addressed later in the development of the Coast Guard's *LNG Vessel Transit Management Plan*. This plan would be developed in conjunction with state and local law enforcement and emergency response communities. In addition, the Coast Guard may establish a moving safety zone and moored vessel security zone under 33 CFR 165 for LNG vessels in transit and while docked. Only personnel or vessels authorized by the COTP are permitted within these zones.

We have evaluated a range of alternatives to the LNG Clean Energy Project, as well as alternatives to various components (e.g., site, pipeline) of the proposed project. The purpose of this evaluation is to determine if there are alternatives that would be both reasonable and environmentally preferable to the project as proposed. Alternatives described in the following sections include no action or postponed action, system alternatives, LNG terminal site alternatives, LNG terminal design alternatives, sendout pipeline alternatives, and dredged material placement alternatives.

Alternatives were evaluated against the specific objectives of the LNG Clean Energy Project, as described in section 1.1. In summary, the primary objectives of the project are to: 1) construct and operate an LNG terminal with marine facilities capable of berthing one LNG ship, an LNG storage capacity of 320,000 m^3, and vaporization facilities; 2) construct and operate a sendout pipeline capable of delivering up to 1.5 Bcfd of natural gas to national markets; 3) utilize existing interstate natural gas

pipeline infrastructure with access to third-party gas processing and underground gas storage for added flexibility in gas supply management; 4) use proven onshore LNG terminal technology; 5) provide geographic diversity in the location of LNG terminals along the Gulf Coast to increase reliability of natural gas supplies, and 6) develop in an area designated for water-dependent industrial use where the community would benefit economically and minimal negative environmental and community impacts would result.

The evaluation criteria for alternatives include whether they:

- are technically and economically feasible and practical;
- offer significant environmental advantage over the proposed project or its components; and
- meet the objectives of the project, as listed above.

With respect to the first set of criteria, it is important to recognize that not all conceivable alternatives are technically and economically feasible and practical. Some alternatives may be impractical because they are unavailable and/or incapable of being implemented after taking into consideration costs, existing technologies, and logistics in light of the overall project purpose. In conducting a reasonable analysis, it is also important to consider the environmental advantages and disadvantages of the proposed action and to focus the analysis on those alternatives that may reduce impacts and/or offer a significant environmental advantage.

The Commission has three possible courses of action in processing an application for a project such as proposed by Gulf LNG. The Commission may: 1) deny the proposal, 2) postpone action pending further study, or 3) authorize the proposal with or without conditions. In arriving at a course of action, the Commission considers a range of alternatives in light of the project's objectives, evaluation criteria, and environmental comparisons. Each alternative is considered until it is clear that the alternative is not reasonable or would result in greater environmental impacts that could not be readily mitigated. Those alternatives that appear to be the most reasonable with less than or similar levels of environmental impact are reviewed in the greatest detail.

Reasonable alternatives to the Coast Guard's proposed action with conditions include: 1) issuance of a Coast Guard LOR finding the waterways suitable for LNG marine traffic without conditions; and 2) issuance of a Coast Guard LOR finding the waterways not suitable for LNG marine traffic (no action alternative).

3.1 NO ACTION OR POSTPONED ACTION ALTERNATIVE

If the Commission denies the proposal (the no action alternative), the short- and long-term environmental impacts identified in section 4 of this EIS would not occur. If the Commission postpones action on the application, the environmental impacts identified in section 4 of this EIS would be delayed, or if the applicant decided not to pursue the project, the impacts would not occur at all. Conversely, if the Commission selects the no action alternative, the objectives of the project would not be met and Gulf LNG would not be able to provide a new source of natural gas to national markets that could be accessed through the proposed interstate pipeline interconnections. For the Coast Guard's proposed action, the no action alternative would be issuance of an LOR that finds the waterway not suitable for LNG marine traffic.

The Energy and Environmental Analysis Foundation, Inc. completed a study in July 2004 for the Interstate Natural Gas Association of America (INGAA). The study determined that natural gas consumers in the United States would pay an extra $200 billion (in constant 2003 dollars) by 2020 if LNG terminals and other natural gas pipeline infrastructure projects being proposed at that time were delayed by a period of 2 years (INGAA, 2004).

As described in section 1.1, projected natural gas demands exceed the currently available supply. Based on recent forecasts by the EIA, natural gas demand in the United States is expected to grow from more than 22 Tcf in 2003 to almost 31 Tcf in 2025 (EIA, 2005). The National Petroleum Council's (NPC) September 2003 publication, *Balancing Natural Gas Policy*, determined that traditional North American producing areas will provide 75 percent of long-term needs for natural gas in the United States, but will be unable to meet projected demand. The NPC study found that the overall level of indigenous production will be dependent on industry's ability to increase its production of nonconventional gas (i.e., gas from tight formations, shales, and coal-bed methane). The NPC study determined that LNG imports and arctic gas (from Alaska's North Slope and Canada's Mackenzie Delta) could meet up to 20 to 25 percent of demand by 2025. The report concluded that nine new LNG terminals and nine terminal expansions that could provide up to 15 Bcfd or 17 percent of the United States natural gas supply would be needed by 2025. Construction of new and expanded LNG capacity would offset demand shortfalls by providing access to supplies of natural gas outside the United States.

As discussed above, projected natural gas demands exceed the currently available supply. Should the no action alternative be adopted, potential customers could select other available energy alternatives, such as oil or coal, or would need to seek traditional non-LNG-derived natural gas to compensate for the reduced availability of natural gas to be supplied by the proposed project. The no action alternative would avoid the potential for environmental impacts associated with project construction and operation. However, failure to provide additional LNG to the domestic market would cause reliance on other natural gas sources and could result in increased prices or shortages for industrial use and electricity generation. Use of alternative fuel sources would have negative economic and environmental effects, both regionally and nationally.

Another potential result of the no action alternative is that another LNG import and storage system could be constructed or an existing facility expanded in place of the LNG Clean Energy Project. Any construction or expansion work would result in specific environmental impacts that could be less than, similar to, or greater than those associated with the LNG Clean Energy Project. We have conducted and included in this EIS an analysis of what appear to be the most reasonable natural gas and LNG system alternatives that have the potential to meet the project objectives (see section 3.2).

A reasonable alternative to the Coast Guard action of issuing an LOR, which finds the waterway suitable for LNG marine traffic with certain conditions, is to issue an LOR without any conditions. With this alternative, some of the adverse economic effects of the conditions would be lessened. For example, the potential cost to the Coast Guard for escort patrols would not be required if the condition of establishment of a moving safety zone was not imposed; the cost to the facility for additional WSAs would not be required if the condition of requiring an annual review of the WSA was not imposed; the cost to the facility for pilots boarding for the transit of LNG vessels from the Horn Island Pass sea buoy (LLNR 320) to the facility and for tug assistance would not be required if this condition was not imposed; and the potential cost to the Coast Guard for security patrols would not be required if the condition for a safety/security zone around the facility was not imposed. However, the potential for adverse environmental effects would be greater if conditions were not imposed. There would be an increase in the potential for adverse environmental effects from collisions, allisions, and terrorist threats if: 1) moving and stationary safety zones were not required; 2) the WSAs were not updated with the most current information on changes in the waterway; 3) a pilot was not required to be aboard the LNG vessel while

transiting the waterway and tug assistance while transiting the waterway and/or while docking was lacking; 4) if a SECURITE announcement before crossing the GIWW was not made; 5) if an *LNG Vessel Transit Management Plan* was not implemented; and 6) if the Coast Guard lacks resources to ensure implementation of security measures.

The proposed alternative is for the Coast Guard to issue an LOR finding the waterway suitable for LNG marine traffic with conditions. These conditions include: 1) establishment of a moving safety zone during LNG vessels' transit of the waterway, including the requirements for daylight transit and one-way LNG marine traffic on the waterway, and for another safety/security zone around the LNG facility when the LNG vessels are moored; 2) the submission by the applicant of an annual review of its WSA to evaluate if any conditions in the waterway have changed that would require issuance of a new LOR and submit the annual review to the COTP for his/her review and issuance of a new LOR if necessary; 3) the requirement that LNG vessels must navigate the waterway from the Horn Island Pass sea buoy (LLNR 320) to the berthing area with a pilot from the Pascagoula Pilots on board and that tug assistance be provided as deemed necessary by the Pascagoula Pilots; 4) the requirement that prior to crossing the GIWW, all LNG traffic will be required to make a SECURITE broadcast; 5) implementation of a Coast Guard-approved *LNG Vessel Transit Management Plan*; and 6) availability of Coast Guard resources to implement the above security measures. If these conditions to the LOR are imposed, the potential for accidental releases or releases from terrorist attacks would be minimized. Considering this and other potential environmental impacts discussed in this EIS, the total potential for adverse environmental impacts from this Coast Guard proposed alternative is not considered significant.

If an LOR is issued determining that the waterway is unsuitable for LNG traffic, then the potential for additional adverse environmental impacts would be avoided, but this would not provide the United States with additional LNG as an alternative source of natural gas. If issuing the LOR is delayed, any potential adverse environmental impacts would only be delayed. However, this alternative would delay providing the United States with additional LNG as an alternative source of natural gas.

The preferred alternative of issuing an LOR with the referenced conditions would allow the LNG vessels to reach the facility with minimal potential adverse environmental impacts, and provide an additional supply of natural gas that would supplement/replace the use of other nonrenewable resources such as coal and petroleum products, and the renewable nuclear fuels.

3.1.1 Energy Source Alternatives

It is purely speculative to predict the reactions of potential end users of the natural gas that would have been supplied by the LNG Clean Energy Project, and the direct or indirect environmental impacts related to their actions, if the Commission selects the no action alternative. However, in the short term, not bringing natural gas to the proposed markets would most likely result in natural gas shortages and increased reliance on other fuel sources (mainly fuel oil) to make up the difference, especially for use in electricity generation. Many natural gas power plants have the option of substituting fuel oil, should natural gas become unavailable or prohibitively expensive. However, the projected national increase in petroleum product consumption through 2025 is similar to that for natural gas. Consequently, there is unlikely to be a surplus of petroleum fuel that could readily provide a cost effective alternative to natural gas without significant new discoveries of crude oil.

The insufficient supply of natural gas that could result under the no action alternative could lead to fuel substitution, most likely from other fossil fuels such as coal or oil. Natural gas is the cleanest burning fossil fuel. Increased use of other fossil fuels with existing emission control technologies would lead to increased emissions of combustion byproducts, including sulfur dioxide (SO_2), nitrogen oxides (NO_x), hydrocarbons, and CO_2 (see table 3.1.1-1).

TABLE 3.1.1-1

Estimated Air Emissions by Fossil Fuel Type for Electric Power Generation

Fossil Fuel Type	CO_2 (lb/kWh)	SO_X (lb/kWh)	NO_X (lb/kWh)
Coal	2.1	0.013	0.0076
Oil	1.6	0.011	0.0021
Natural Gas	1.0	0.000007	0.0018

Source: Estimated emissions are based on total emissions and total electrical power production for each fossil fuel type, as reported in the EIA's Annual Energy Review 2003 (EIA, 2004a).

CO_2 carbon dioxide
lb/kWh pounds per kilowatt hour
NO_x nitrogen oxides
SO_x sulfur oxides

Natural gas combustion generates 34 to 52 percent less CO_2 than conventional fuels, such as oil or coal. Other emissions from natural gas combustion, including carbon monoxide (CO), are also significantly lower than those from oil or coal. CO_2 and CO contribute to global warming. Ash residues from the combustion of coal are caustic and must be disposed of in landfills, taking valuable land out of use and adding to the expense of its use. Special landfills must be used to prevent acidic rainwater, caused by rain mixing with the ash, from leaching metals from the soil into the groundwater. No such residue results from the combustion of natural gas. Thus, the use of other fossil fuels in place of natural gas would increase atmospheric pollution and waste volumes, and would incur secondary impacts associated with production (e.g., coal mining and oil drilling), transportation (e.g., oil tankers, rail cars, and pipelines), and refining. In addition, the handling and use of petroleum products have historically led to a greater occurrence of spills than the handling and use of LNG. Moreover, spills of LNG will gasify, leaving no residue in water and soil. Methane is not ozone (O_3)-depleting and has a very low global warming potential.

Other traditional long-term fuel source alternatives to natural gas for electric generation are nuclear power, hydropower production, and development of renewable energy sources. The radiation from nuclear fuel handling and use has a historically greater potential for adverse environmental impacts (i.e., Chernobyl) than the use of LNG. In addition, spent nuclear fuel must be disposed of in special storage facilities with safeguards to protect the environment. Because of permitting, cost considerations, nuclear waste disposal, and potential public concerns, new sources of nuclear power are unlikely to appear in the near future. It is also unlikely that significant new hydropower sources could be permitted and brought online as a reliable alternative to the LNG provided by Gulf LNG's proposed project.

Although technology is improving and costs are declining for renewable energy (e.g., wind, solar, and biomass), the percentage of national electricity generated from non-hydropower renewable energy sources is projected to increase from 2.2 in 2002 to only 3.7 in 2025 (EIA, 2004b). Consequently, the quantity of energy generated from non-hydropower renewable energy sources is not likely to provide a reasonable alternative to an increased natural gas supply.

Another alternative energy source would be traditional non-LNG-derived natural gas. While natural gas production is important to the overall supply of energy nationally, production levels are not expected to rise in the short term, except from the Arctic and from unconventional sources (e.g., shale, tight sands, and coal-bed methane) in the Rocky Mountain region. Given a projected increase in natural gas demand in the Rocky Mountain region itself, these unconventional sources would not provide a reasonable alternative to the LNG Clean Energy Project. Likewise, natural gas from the Arctic is not a reasonable alternative because those supplies alone would be insufficient to meet projected increases in demand.

3.1.2 Energy Conservation Alternatives

Energy conservation and increased efficiency in energy production have been a component of the national energy agenda since the Arab Oil Embargo in the mid-1970s. However, while energy conservation can play a critical role in the future of the United States energy sector, growth projections continue to indicate that the demand for energy, and specifically natural gas, will outstrip cost-effective programs designed to stimulate energy conservation. For example, the Oak Ridge National Laboratory analyzed data from the DOE's State Energy Program. The State Energy Program is a federally funded, state-based program administered by the DOE (the only such program administered by the DOE) that provides financial and technical assistance for a variety of energy efficiency and renewable energy activities. The Oak Ridge National Laboratory determined that the program resulted in an estimated annual energy savings of approximately 41 trillion Btu (Schweitzer et al., 2003). To put this amount of energy in context, the United States consumed 98 quadrillion Btu of total energy in 2002, roughly 2,400 times the 41 trillion Btu of energy savings reported by the Oak Ridge National Laboratory. For further context, 41 trillion Btu per year of energy saved would offset the use of approximately 105 billion cubic feet of natural gas, less than one-fifth of the volume that would be supplied by an LNG import project the size of the LNG Clean Energy Project.

In addition to state energy management programs, federal and state programs exist to enhance energy conservation across the various energy use sectors. In Mississippi for example, the Mississippi Development Authority's Energy Division promotes energy efficiency in all sectors and supports the development and application of alternative energy technologies. On a national basis, the EPA's ENERGY STAR program assists residential and business users in reducing environmental impacts through energy efficiency. While these programs have contributed to energy conservation, growth in energy demand and the need to service that demand will continue to significantly outpace the existing supplies. Furthermore, these are mature programs that could not be significantly expanded at a reasonable cost and on a voluntary basis to meet the energy potential of the LNG Clean Energy Project.

In summary, we believe that existing energy conservation programs cannot fully offset the projected growth in national demand for energy, and a corresponding demand for natural gas. Continued economic growth, particularly growth of electricity demand, throughout the United States will lead to increased natural gas use, despite programs to encourage energy conservation. Thus, energy conservation alone would not preclude the need for the LNG Clean Energy Project.

3.2 SYSTEM ALTERNATIVES

System alternatives would make use of other existing or proposed LNG or natural gas facilities to meet the stated objectives of the proposed project. A system alternative would make it unnecessary to construct all or part of the proposed project, although some modifications or additions to the existing or proposed facilities may be necessary. These modifications or additions would result in environmental impacts that could be less than, similar to, or greater than those associated with construction of the LNG Clean Energy Project. Ultimately, the point of identifying and evaluating system alternatives is to determine whether potential environmental impacts associated with the construction and operation of the LNG Clean Energy Project could be avoided or reduced by using another system.

As noted above and described in section 1.1, one of the specific objectives of the LNG Clean Energy Project is to provide up to 1.5 Bcfd of natural gas via the existing interstate pipeline grid to national markets. The analysis below examines the existing and proposed LNG and natural gas systems that currently or could eventually serve these markets, and considers whether those systems offer an environmental advantage over the LNG Clean Energy Project and could meet the project objectives.

To be considered a viable LNG system alternative, the existing facility, proposed project, or authorized project would need to provide LNG ship unloading, storage, and sendout capacities similar to Gulf LNG's proposal. Also, the facilities would need to be in a location with access to interstate natural gas pipelines.

3.2.1 Onshore LNG Terminal System Alternatives

3.2.1.1 Existing Onshore Facilities

There are four existing onshore LNG import terminals that provide unloading, storage, and delivery services in the United States.[1] These facilities are operated by Trunkline LNG Company L.L.C. (Trunkline) at Lake Charles, Louisiana; Southern LNG Inc. (Southern) at Elba Island, Georgia; Cove Point LNG, L.P. (Cove Point) in Calvert County, Maryland; and Distrigas of Massachusetts (Distrigas) at Everett, Massachusetts. The Cove Point terminal is currently being expanded, and is considering another expansion in the near future. Trunkline also recently filed an application to expand its LNG facilities. The Southern, Cove Point, and Distrigas facilities were built mainly to serve specific local markets (southeast, mid-Atlantic, and New England, respectively). These East Coast facilities are not connected to, and could not reasonably access, the interstate pipeline system. Because of their location and the existing infrastructure, any additional LNG delivered to these three existing import terminals would be to serve the local markets and would not meet the objective of the proposed project to provide natural gas to national markets through an interstate pipeline system.

The existing Trunkline LNG terminal in Lake Charles, Louisiana is the largest operating LNG import terminal in the United States. The Commission has recently approved expansion of the Trunkline facility, including a second berth, another LNG storage tank (in addition to the three existing LNG storage tanks), and additional vaporization capability. These new facilities will increase the sendout capacity of the terminal to 1.3 Bcfd. Because of its location, the Trunkline facility could tie into the interstate pipeline system and serve the same markets targeted by the proposed project (see section 3.2.1.3).

3.2.1.2 Approved and Proposed Onshore Projects

A number of onshore LNG terminal projects are being proposed in the United States. As discussed above relative to existing LNG terminals, the East Coast does not have the appropriate interstate pipeline infrastructure in place that would be needed to satisfy the project objective of natural gas delivery to national markets via interstate pipeline systems. Likewise, existing pipeline systems along the West Coast are designed for localized and regional distribution and could not service national markets. Therefore, approved and proposed LNG import terminal projects on the East and West Coasts were not considered to be viable alternatives to the proposed project.

Interstate pipeline systems having the capacity to service national markets are available along the Gulf Coast and a number of onshore LNG import terminals have been recently approved or proposed in this region. Table 3.2.1-1 identifies the major onshore facilities that have been approved or proposed along the Gulf of Mexico and summarizes the regulatory status of each project.

Authorized Projects

The Commission has authorized nine new onshore LNG import facilities along the Gulf of Mexico. Construction has begun on the Cameron LNG Project near Hackberry, Louisiana; Sabine Pass LNG Project in Sabine Pass, Louisiana; Golden Pass LNG Project in Sabine Pass, Texas; Freeport LNG

[1] There is also an existing LNG import terminal located at Guayanilla Bay, Puerto Rico.

Project in Freeport, Texas; and Cheniere Corpus Christi LNG Project in Corpus Christi, Texas. Construction is pending on the Ingleside Energy Center LNG Project and Vista del Sol LNG Terminal Project, both in Corpus Christi, Texas; the Port Arthur LNG Project in Port Arthur, Texas; and the Creole Trail Project in Cameron Parish, Louisiana.

While most of these onshore LNG import terminals will have sendout pipelines that interconnect with interstate pipeline systems and could meet the primary objective of the LNG Clean Energy Project, the Freeport LNG import terminal, located about 188 miles northeast of Corpus Christi, does not provide access to the interstate natural gas market as currently approved. It is designed to serve only the Texas intrastate market. A recently filed application to expand the terminal capacity does not include plans to access the interstate pipeline system and expand beyond local markets.

Proposed Projects

As identified in table 3.2.1-1, we are currently analyzing two other proposed onshore LNG import terminal projects located along the Gulf Coast. These projects would both have access to interstate pipelines. One of these planned projects, the Calhoun LNG Project in Port Lavaca, Texas, would be sited a considerable distance (about 500 miles) from Gulf LNG's proposed terminal site.

The Casotte Landing LNG Project would be located on the east side of Bayou Casotte in Pascagoula, Mississippi north of Gulf LNG's proposed LNG terminal site. The Casotte Landing LNG terminal would be owned by Bayou Casotte Energy and would be adjacent to Chevron's Pascagoula Refinery. The project would use waste heat from the refinery's cooling water towers for vaporization of the LNG. The Casotte Landing LNG Project would include a double ship berth shared with the refinery, three LNG storage tanks, and a 0.6-mile-long sendout pipeline with interconnections to the interstate Gulfstream pipeline and three smaller pipelines. The target market for the Casotte Landing LNG Project would be the Southeast. The total output of the facility would be 1.3 to 1.6 Bcfd. Bayou Casotte Energy anticipates 170 LNG ships would unload at the facility per year.

3.2.1.3 Conclusions Regarding Onshore LNG Terminal System Alternatives

As indicated above, the existing and proposed LNG import terminals on the East and West Coasts would not be viable alternatives to the LNG Clean Energy Project because they are not connected to, and could not reasonably access, existing interstate pipeline systems. The one existing LNG import terminal on the Gulf Coast accesses an interstate pipeline system, and all but one of the approved and proposed onshore LNG import terminals along the Gulf Coast also plan to access existing interstate pipeline systems. These projects appear to be technically, economically, and environmentally reasonable systems for meeting a number of the objectives of the LNG Clean Energy Project. However, the FERC does not consider these projects as alternatives to one another. Rather, these facilities would all provide a mechanism for importing LNG, and each could help satisfy the increasing demand for natural gas (see section 1.1). Furthermore, each project has its own unique purpose and need (i.e., the projects are not readily interchangeable). Although all of these facilities, except the Freeport LNG terminal, would interconnect with existing interstate pipeline systems and could serve broader national markets, most also target local and/or regional markets. Their locations are chosen accordingly.

TABLE 3.2.1-1

Approved and Proposed Onshore LNG Import Terminals Along the Gulf of Mexico

Project Name *Applicant*	Location	Sendout Capacity (Bcfd)	Number of Storage Tanks and Capacity	Status [a]
Approved Terminals				
Cameron LNG Project *Cameron LNG, LLC*	Hackberry, LA	1.5	Three 160,000 m^3 tanks	FERC approval issued September 2003; construction underway; FERC Docket No. CP02-374-000.
Sabine Pass LNG Project *Sabine Pass LNG, L.P.*	Sabine Pass, LA	4.0	Six 160,000 m^3 tanks	FERC approval issued December 2004 for phase 1 and June 2006 for phase 2 expansion; construction underway; FERC Docket No. CP04-47-000.
Golden Pass LNG Project *ExxonMobil Corporation*	Sabine Pass, TX	1.0 (phase 1) 2.0 (phase 2)	Five 160,000 m^3 tanks	FERC approval issued July 2005; construction underway; FERC Docket Nos. CP04-386-000 and CP04-400-000.
Freeport LNG Project *Freeport LNG Development L.P.*	Freeport, TX	1.5 (phase 1) 2.5 (phase 2, proposed)	Two 160,000 m^3 tanks One 160,000 m^3 tank (phase 2, proposed)	FERC approval issued June 2004 for phase 1; construction underway; FERC Docket No. CP03-75-000. Proposed phase 2 expansion application filed May 2005; FERC Docket No. CP05-361-000.
Cheniere Corpus Christi LNG Project *Corpus Christi LNG L.P.*	Corpus Christi, TX	2.6	Three 160,000 m^3 tanks	FERC approval issued April 2005; construction underway; FERC Docket Nos. CP04-37-000, CP04-44-000, CP04-45-000, and CP04-46-000.
Ingleside Energy Center LNG Project *Ingleside Energy Center, LLC*	Corpus Christi, TX	1.0	Two 160,000 m^3 tanks	FERC approval issued July 2005; construction pending; FERC Docket No. CP05-13-000.
Vista del Sol LNG Terminal Project *Vista del Sol LNG Terminal L.P.*	Corpus Christi, TX	1.0	Three 160,000 m^3 tanks	FERC approval issued July 2005; construction pending; FERC Docket Nos. CP04-395-000, CP04-405-000, and CP04-374-000.
Port Arthur LNG Project *Port Arthur LNG, L.P.*	Port Arthur, TX	1.5 (phase 1) 3.0 (phase 2)	Three 160,000 m^3 tanks	FERC approval issued June 2006; construction pending; FERC Docket Nos. CP05-83-000, CP05-84-000, CP05-85-000, and CP05-86-000.
Creole Trail Project *Creole Trail LNG, L.P. and Cheniere Creole Trail Pipeline Company*	Cameron Parish, LA	3.3	Four 160,000 m^3 tanks	FERC approval issued June 2006; construction pending; FERC Docket Nos. CP05-357-000, CP05-358-000, CP05-359-000, and CP05-360-000.
Proposed Terminals				
Calhoun LNG Project *Calhoun LNG, L.P.*	Port Lavaca, TX	1.0	Two 160,000 m^3 tanks	FERC application filed March, 2005; Draft EIS issued June 2006; FERC Docket No. CP05-91-000.
Casotte Landing LNG Project *Bayou Casotte Energy, LLC*	Pascagoula, MS	1.3 to 1.6	Three 160,000 m^3 tanks	Application filed October 2005; Draft EIS issued May 2006; FERC Docket No. CP05-420.

[a] Project information as of October 2006. Obtained from EPA informal dockets and publicly available project applications and EISs. More specific information for many of these projects, including in-depth environmental analysis, can be obtained from the FERC document management system (see http://www.ferc.gov/docs-filing/elibrary.asp).

Bcfd billion cubic feet per day
FERC Federal Energy Regulatory Commission
m^3 cubic meters

The LNG Clean Energy Project and the Casotte Landing LNG Project are located farther east (by as far as 600 miles) than any of the other approved and proposed onshore LNG terminals along the Gulf Coast. This minimizes the transportation distance to primary national markets accessed by interconnects with the Destin and Gulfstream pipelines. As described in section 1.1, the Gulfstream pipeline serves the Florida natural gas market and the Destin pipeline provides access to six major pipelines that serve the Southeast, Mid-Atlantic, and Northeast. The Destin interconnect also would provide access, through backhaul capacity, to other major markets in the United States. The spatial separation between these projects and the other proposed onshore LNG terminals along the Gulf of Mexico also offers important geographic diversity in the locations of these types of facilities, which increases the overall reliability of natural gas supplies. At this time, it is not possible to foresee which (if any) of the proposed LNG projects will move forward and be constructed.

Because the LNG Clean Energy Project and Casotte Landing LNG Project are in close proximity, and both would interconnect to the existing Gulfstream pipeline system, the FERC considered the alternative of combining them into a single LNG terminal system.

In general, there are two avenues by which the goals of multiple LNG projects could be satisfied by developing a single system alternative. First, a single company could build facilities that could satisfy the objectives of multiple projects. However, the authorized and proposed LNG import terminals along the Gulf of Mexico (including the LNG Clean Energy Project and the Casotte Landing LNG Project) are proposed by separate applicants and/or are designed to achieve unique objectives. Combining two or more of the projects into a single system would likely involve either the elimination of one or more of the proposals or a comprehensive synchronization of the respective LNG chains (source development to market).

Second, two companies could build LNG facilities that would satisfy the objectives of their respective projects at a single property. However, in the case of the Casotte Landing LNG Project, property at the proposed LNG terminal site is not available to Gulf LNG. Conversely, the Casotte Landing LNG Project relies on collocation with Chevron's Pascagoula Refinery to provide a heat source for LNG vaporization, so it could not be moved to Gulf LNG's proposed terminal site. Furthermore, we do not believe that there are significant advantages to combining or collocating two or more different LNG project facilities on a single property. If two or more of the LNG projects were built on the same site, additional space would be required to accommodate the construction of additional ship berths, storage tanks, vaporization equipment, and combined pipeline facilities. Building two LNG facilities at a single property would not lessen local ship traffic, and ship congestion in the immediate vicinity of a marine terminal could pose significant logistical difficulties.

In considering either of these approaches, we would first need to establish that unacceptable impacts exist at a proposed LNG terminal site. At this time, our review of the impacts and proposed mitigation for each project has not revealed any unacceptable impacts. The Commission will evaluate each project individually based on its merits, and at the time of its decision will be fully apprised of the individual as well as the cumulative environmental impacts. To ensure that our analysis was complete and included local and regional issues, we conferred with appropriate agencies and held public meetings. The cumulative impacts analysis in section 4.14 of this EIS addresses the potential combined environmental impacts of multiple LNG projects in the Pascagoula area, should both the LNG Clean Energy and the Casotte Landing LNG Projects be built.

3.2.2 Offshore LNG Terminal System Alternatives

To avoid many of the environmental issues and safety concerns associated with locating an LNG facility onshore, many companies have considered constructing LNG import terminals at ports located

offshore. As defined in the Deepwater Port Act of 1974 (as amended by the Maritime Transportation Security Act of 2002 to include natural gas facilities), deepwater ports include fixed or floating structures that are located in federal waters off of the coast of the United States and that are used as a port or terminal for the transportation, storage, and further handling of oil or natural gas. This legislation further requires the DOT (U.S. Maritime Administration (MARAD)) and Coast Guard to regulate the licensing, siting, construction, and operation of deepwater ports for natural gas. Offshore LNG import facilities located in state waters fall under the jurisdiction of the FERC. Offshore facilities also include floating unloading buoy and riser systems that allow LNG ships with vaporization equipment onboard to inject natural gas directly into offshore pipelines. Table 3.2.2-1 lists approved and proposed offshore LNG terminals in the Gulf of Mexico.

3.2.2.1 Fixed or Floating LNG Import Structures

There are basically two different types of structures that can be used as an offshore LNG import terminal. These include: 1) fixed structures that have ship docking and unloading facilities, regasification units, and other associated equipment on pile-based platforms or concrete structures and foundations located directly on the seafloor; and 2) floating units comprised of storage tanks, offloading, and vaporization facilities. Both designs would allow docking and unloading of LNG ships and vaporization of LNG for delivery to onshore markets via undersea pipelines.

One strategy to build a fixed offshore terminal would be to use a gravity-based structure (GBS). A GBS facility would include placing LNG storage tanks and associated facility platforms on foundations directly on the seafloor. LNG could be offloaded from conventional LNG ships, placed in storage tanks, and then vaporized for delivery as natural gas to the onshore market via an undersea pipeline. GBS terminals would only be feasible in areas of relatively shallow water, where the depths range between 45 and 100 feet. Given the expense associated with constructing and operating a GBS, it appears that these facilities are only economically feasible for projects with relatively large LNG storage (e.g., 250,000 to 330,000 m^3) and natural gas sendout volumes (e.g., 800 to 2,000 million cubic feet per day (MMcfd)). As indicated in table 3.2.2-1, the Port Pelican Offshore Deepwater Port Project and the Gulf Landing Project have received preliminary authorizations to construct facilities of this design in the Gulf of Mexico. With the exception of the Gulf Gateway Deepwater Port (see section 3.2.2.2), these are the only offshore facilities approved for construction in the United States.

Another strategy using a fixed offshore terminal involves constructing or converting existing offshore platforms. Because these platforms are or would be anchored using fixed-tower structures, they could be located in a much broader range of water depths than a GBS unit. These platforms could be fitted with docking, unloading, storage, and vaporization equipment. Similar to the GBS design, LNG could be unloaded from a conventional LNG ship, vaporized at the platform, and sent as natural gas to the onshore market via an undersea pipeline. Depending on the specific design, the use of an offshore platform may not include significant offshore storage of LNG. Crystal Energy, L.L.C. recently proposed using an existing platform as a terminal to import natural gas to markets in California. In addition, the Main Pass Energy Hub Project (see table 3.2.2-1) would develop a deepwater LNG terminal on a series of existing connected platforms used to mine sulfur about 16 miles off the coast of southeast Louisiana. Reuse of existing platforms would involve identifying decommissioned production facilities and determining whether these facilities were appropriate for conversion to import LNG, both of which are beyond the scope of this analysis.

TABLE 3.2.2-1

Approved and Proposed Offshore LNG Terminals in the Gulf of Mexico

Project Name *Applicant*	Location	Sendout Capacity (Bcfd)	Type and Storage Capacity	Status [a]
Approved Terminals				
Gulf Landing Project *Shell USA Oil and Gas*	Gulf of Mexico, West Cameron Block 213, offshore LA	1.0	GBS, 200,000 m^3	U.S. Coast Guard (Coast Guard) final EIS issued; MARAD Record of Decision completed February 2005; Gulf Landing accepted and signed deepwater port license issued by MARAD June 2006; Coast Guard Docket No. 16860.
Port Pelican Offshore Deepwater Port Project *ChevronTexaco*	Gulf of Mexico, Vermilion Block 140, offshore LA	2.0	GBS, 330,000 m^3	MARAD Record of Decision issued November 2003; Licensee has formally put project on hold indefinitely.
Gulf Gateway Deepwater Port *Excelerate Energy*	Gulf of Mexico, 116 miles south of Cameron, LA	0.5	Floating, no storage	Began operation March 2005.
Proposed Terminals				
Compass Port Project *ConocoPhillips*	Gulf of Mexico, offshore AL	1.0	GBS, 300,000 m^3	Application filed March 2004; final EIS published April 2006; Alabama Governor denied application based on use of open rack vaporizers (ORV); ConocoPhilips withdrew application June 2006 and all activity on project has ceased; Coast Guard Docket No. 17659.
Beacon Port LNG Project *ConocoPhillips*	Gulf of Mexico, High Island Block 27, offshore LA	1.5	GBS, 300,000 m^3	Application filed January 2005; final EIS expected to be issued end of October 2006; Coast Guard Docket No. 21232.
Main Pass Energy Hub Project *Freeport-McMoRan Energy, LLC*	Gulf of Mexico, Main Pass Block 299, offshore LA	2.5	Platform, two 300,000 m^3 tanks	Application filed February 27, 2004; final EIS published March 2006; application amendment for using a closed-loop vaporization system currently under environmental review; Coast Guard Docket No. 17696.
Bienville Port Project *TORP Terminal LLP*	Gulf of Mexico, approximately 60 miles south of Fort Morgan, AL	1.4	Platform, two HiLoad LNG regasification units	Application filed January 2006 but deemed incomplete; application deemed sufficiently complete May 2006; Notice of Intent published June 2006; Coast Guard Docket No. 24644.

[a] Project information as of October 2006. Obtained from LNG Express (Vol. XVI, No. 12, June 15, 2006) and publicly available project applications and EISs. More specific information for many of these projects, including in-depth environmental analysis, can be obtained from the FERC or Coast Guard document management systems (see http://www.ferc.gov/docs-filing/elibrary.asp and http://dms.dot.gov/).

Bcfd billion cubic feet per day
m^3 cubic meters
GBS gravity-based structure
MARAD U.S. Maritime Administration

Floating, storage, and regasification units (FSRU) are another approach being considered for importing LNG into the United States. In essence, an FSRU would be an oversized LNG carrier vessel that is outfitted with LNG vaporizers and docking/unloading equipment. The FSRU would be up to 1,200 feet long, 180 to 215 feet wide, and would be able to store between 250,000 and 350,000 m^3 of LNG; over twice the capacity of typical LNG ships that are currently available. These units would be anchored offshore of the proposed market area where conventional LNG ships could dock next to and unload LNG to the FSRU. After the LNG is unloaded, it could be vaporized and the natural gas could be transported to onshore markets through an undersea pipeline. Depending on the vaporizers and the size of the pipeline, these units could have a natural gas sendout capacity ranging from 700 to 1,500 MMcfd. Companies are currently proposing to use this design to import natural gas to markets in southern California and the Long Island Sound area.

We have considered offshore LNG terminals with either a fixed or floating design to determine if they could provide an import service similar to the LNG Clean Energy Project and if suitable sites could be located and developed in the waters of the Gulf of Mexico. By constructing an LNG terminal offshore, some of the more significant environmental impacts associated with the proposed project could be avoided (e.g., permanent fill of coastal wetlands, dredging impacts in Gulf sturgeon critical habitat, safety concerns raised by local residents). Although a fixed or floating LNG import terminal located offshore would generally increase the distance of the facility from populated areas, there are operational and environmental tradeoffs associated with offshore LNG technology. Additionally, one congressional report suggested that offshore LNG facilities may be more vulnerable to terrorist attack compared to an onshore facility (Parfomak, 2003).

The GBS facilities in the Gulf of Mexico that have been proposed to date (see table 3.2.2-1) would use seawater intake systems for vaporization. As discussed further in section 3.4.2, this process results in significant amounts of cool water that is discharged back to the water source. Additionally, the large volumes of seawater that would be required for this vaporization approach would increase the potential for large numbers of fish eggs and larvae to be entrained during the process. For this reason, the currently proposed offshore LNG terminals have faced increasingly strong opposition from the NMFS and other agencies, as well as commercial fishing interests and environmental groups.

Another issue is that the use of an offshore facility does not avoid the need for some onshore facilities. Temporary onshore facilities would be needed to construct the fixed or floating structures, which would then be transferred to the offshore terminal location. The construction of a GBS requires fabrication of the GBS in what is referred to as a graving dock. The graving dock site must be of sufficient size to fabricate the GBS, and be adjacent to water deep enough to float the GBS. One side of the graving dock must be directly adjacent to the waterbody, and that side must be removable to flood the dock and float the GBS, allowing it to be towed from the dock to its final destination. A graving dock for the size of the proposed LNG terminal would be on the order of 50 to 100 acres and would require the dredging of between 2 and 3 million yd^3 of material. FSRUs could likely be constructed at existing shipyards. Permanent onshore facilities would also be required for terminal support activities.

An LNG import terminal that is located in an offshore setting would also have greater exposure to the effects of meteorological and oceanographic forces such as high winds, waves, and currents. The potential for severe weather equates with a need for increased storage volume at offshore terminals to maintain a predictable, constant flow of natural gas to shore. A key technical issue for the successful operation of an LNG terminal in this environment includes designing the LNG transfer system (i.e., unloading arms) to compensate for the relative motion between the terminal and LNG ship during unloading operations. Although storage and unloading technologies similar to those that would be used with an offshore LNG terminal have been applied for many years at onshore LNG terminals and at offshore petroleum product facilities (LNG Express, 2002), the technologies needed to transfer a

cryogenic liquid under the potentially harsher conditions in an offshore setting have yet to be demonstrated. This challenge would be greater for offloading to an FSRU where the stresses on a transfer system could be even greater than what would be experienced at a fixed structure.

A review of the EIS for the Port Pelican Offshore Deepwater Port Project indicates that environmental impacts associated with construction and operation of a gravity-based LNG terminal would primarily be related to water quality, biological communities, socioeconomics, and air quality (Coast Guard, 2003). Many of these impacts are the result of employing an open-rack vaporization system, rather than being inherent to the GBS design. For example, water discharged from the vaporizer units would decrease the water temperature, increase turbidity, and increase dissolved oxygen content in marine waters within about 300 feet of the terminal. The terminal would also serve as an artificial reef, potentially resulting in minor beneficial impacts on the populations of commercial and recreational fish species. However, intake structures would impinge or entrain fish eggs or larvae that are floating in nearby waters. A safety zone would preclude commercial or recreational fishing within about 1,640 feet of the Port Pelican terminal. In July 2005, ChevronTexaco announced that it had put the Port Pelican Project on hold indefinitely.

Offshore LNG terminals also result in disturbance to the seafloor during construction of the pipelines used to deliver the natural gas to shore. Construction methods for offshore pipelines include jetting, subsea plowing, and dredging. Excavating a shallow trench to bury the pipeline using any of these methods would have both direct and indirect impacts. Direct impacts would include the disturbance of bottom substrates and habitats located in the area of the trench. Other impacts could include the disturbance of substrates adjacent to the trench as a result of sidecasting the trench spoil, and impacts associated with anchor strikes and cable sweep resulting from the need to stabilize and position pipe-lay barges and other equipment. Indirect impacts would include the suspension and transport of disturbed sediments in the water column and the resettlement of suspended sediments on the seabed. Laying the pipeline directly on the seafloor could also displace and/or replace existing substrates and, in some cases, create a potential barrier to invertebrate movements (Glaholt et al., 2000). Although the use of the HDD method can help mitigate impacts, construction in nearshore or shallow waters can impact particularly sensitive habitats (e.g., seagrasses, coastal marsh).

The evaluation of a fixed or floating offshore facility as an alternative to this project cannot merely transpose the onshore facility to an offshore location. Rather, it represents a complete redesign of the entire facility such that the feasibility of meeting the operational and economic objectives of the proposal is not possible or is less certain. For example, estimates released to the public indicate that the capital costs for constructing an offshore terminal that includes significant LNG storage would be at least twice as expensive as a similar sized onshore facility. When considering the current level of information and operational experience as well as the level of impacts associated with offshore LNG facilities, we do not consider these facilities to be environmentally preferable and practicable alternatives to the LNG Clean Energy Project.

3.2.2.2 Transport and Regasification Vessels

Several companies have proposed the installation of vaporization equipment on conventional LNG carrier ships, which would be called transport and regasification vessels. These ships would be able to dock at a floating unloading buoy and riser system where LNG could be vaporized onboard the LNG ship and injected directly into offshore pipelines that interconnect with onshore natural gas transmission systems. The vaporization equipment located on the ships would use technology that is similar to land-based LNG terminals.

In March 2005, the first project using this strategy began operation and is the only existing offshore LNG import terminal of any type in North America. Excelerate's Gulf Gateway Deepwater Port includes a submerged turret loading system and about 8 miles of 20-inch-diameter pipeline that connects to two existing subsea pipelines located about 116 miles south of Cameron, Louisiana (LNG Express, 2002 and 2003). Excelerate ordered three LNG ships to be constructed to include onboard vaporization equipment. One of these ships is now in service and is delivering natural gas to the United States.

Because LNG is vaporized on board the LNG ship, this approach eliminates the need for fixed LNG storage. Some of the tradeoffs of this approach are that it requires a dedicated LNG fleet with vaporization equipment on all of the vessels. Additionally, it takes 6 to 10 days to unload a ship at a maximum design rate of about 0.5 Bcfd. Because of the limited delivery capacities and the need for specially modified LNG ships, we do not consider this system a viable alternative to the proposed LNG Clean Energy Project.

3.2.3 Pipeline System Alternatives

As an alternative to constructing a new LNG import terminal, we considered the feasibility of utilizing or expanding existing pipeline systems to provide an equivalent amount of natural gas to large national markets, as proposed by Gulf LNG. However, expanding existing pipelines would not provide non-domestic sources of natural gas to augment domestic sources. There are no existing pipelines that connect the source areas for the LNG to the delivery interconnections proposed by Gulf LNG. Section 1.1 describes how the demand for natural gas is growing at a faster rate than production in the United States and Canada, and therefore, it is unlikely that pipeline alternatives could meet the project objective of providing a new supply of natural gas to national markets.

3.3 LNG TERMINAL SITE ALTERNATIVES

Alternative sites for an LNG import terminal were considered based on various environmental, engineering, economic, safety, and regulatory factors. The first step was to identify the most suitable region within the United States for an LNG terminal based on the stated purpose of the proposed project. The second step was the identification of specific ports within the selected region that could accommodate LNG marine traffic and allow access to interstate pipeline systems. The third step was the evaluation of suitable sites within those ports meeting project objectives.

3.3.1 United States Review

The purpose of the LNG Clean Energy Project is to provide a new source of natural gas to serve large national natural gas markets. The Gulf of Mexico region has well-developed interstate pipeline systems with a capacity of more than 27 Bcfd; therefore, potential port locations along the Gulf Coast were examined. Ports on the East and West Coasts were eliminated from further consideration because they could not access the major interstate pipeline network of the Gulf Coast that would allow distribution to the national markets that Gulf LNG proposes to serve.

3.3.2 Regional Site Screening

Gulf LNG evaluated existing deepwater ports along the Gulf Coast that would be suitable for siting an LNG import terminal. In the first phase of the screening, Gulf LNG assessed the ports to determine if other entities had proposed development of an LNG terminal at the available site(s) within these port locations. As shown in table 3.3.2-1, Gulf LNG determined that the available site(s) within seven of the ports had already been optioned by other entities for development. Eight ports were further evaluated using the following criteria:

- access and proximity to interstate pipelines that would allow delivery of up to 1.5 Bcfd of natural gas;
- existing ship traffic conditions that are not overly congested; and
- access to a deepwater channel to accommodate LNG ships with cargo capacities of 125,000 m^3 to 250,000 m^3.

TABLE 3.3.2-1

Regional Site Screening Results

Port Location	Already Proposed for LNG Project	Access/Proximity to Interstate Pipeline	Uncongested Shipping Routes	Adequate Shipping Channel Depth/Width
Brownsville, Texas	no	no	no	yes
Corpus Christi, Texas	yes	--	--	--
Aransas, Texas	yes	--	--	--
Port Lavaca, Texas	yes	--	--	--
Freeport, Texas	yes	--	--	--
Galveston, Texas	no	no	no	yes
Houston, Texas	no	--	no	yes
Port Arthur, Texas	yes	--	--	--
Sabine Pass, Texas	yes	--	--	--
Texas City, Texas	no	no	no	yes
Port Cameron, Louisiana	yes	--	--	--
Gulfport, Mississippi	no	yes	yes	no
Mobile Bay, Alabama	no	yes	yes	[a]
Pascagoula, Mississippi	no	yes	yes	yes
Tampa Bay, Florida	no	no	--	yes

[a] According to the Alabama State Port Authority, the current navigation channel maintained by the U.S. Army Corps of Engineers provides a navigational depth of 45 feet from the Gulf of Mexico to the mouth of the Mobile River. The channel then becomes 40 feet deep and proceeds north to the Cochrane/Africatown Bridge passing over the Bankhead and Wallace tunnels. Depending on the location of a proposed LNG terminal, adequate channel depth could be available.

-- not evaluated

Only Pascagoula, Mississippi met all of the screening criteria. Mobile Bay, Alabama may also meet all of the screening criteria; however, due to strong local public opposition to LNG projects and uncertainty about adequate channel depths, it was eliminated from further consideration.

3.3.3 Local Site Screening

We considered other potential properties in the Pascagoula area as alternatives to the proposed LNG Clean Energy Project site. The locations were constrained in that they had to be adjacent or very near the Bayou Casotte Channel or the Pascagoula Channel to allow access for the LNG ships. The location needed to be reasonably accessible to interstate natural gas pipelines and gas processing facilities. Other factors considered were size, configuration, current use, and surrounding land use. For this analysis, we assumed the alternative sites would be the same or very similar in size and configuration to the proposed site, so that the same facility design could be used. The proposed site and associated facilities are described in detail in section 2.1.1. Two alternative sites, the North Alternative and the East Alternative, were identified and are described below. These sites are also depicted on figure 3.3.3-1 and their relevant characteristics are compared in table 3.3.3-1.

Non-Internet Public

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LNG CLEAN ENERGY PROJECT
Docket Numbers CP06-12-000, CP06-13-000

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Figure 3.3.3-1 Alternative Sites in the Pascagoula Area

Public access for the above information is available only through the Public Reference Room, or by e-mail at public.referenceroom@ferc.gov.

TABLE 3.3.3-1

Pascagoula Area LNG Terminal Site Alternatives

Resource Issue	Proposed Site	North Alternative	East Alternative
Current Land Use	unused	BCDMMS	BCDMMS
Approximate Dredging Required	3 million yd^3	2 million yd^3	9 million yd^3
Approximate Distance to Ship Channel	2,000 feet	1,400 feet	4,200 feet
Sendout Pipeline Length	5.0 miles	4.6 miles	4.2 miles
Approximate Wetlands Affected [a]	3.3 acres	13 acres	30 acres
Gulf Sturgeon Critical Habitat Affected	yes	yes	yes

[a] Wetland data for the proposed site is based on a wetland delineation. Data for the alternative sites is based on NWI maps.

yd^3 cubic yards

BCDMMS Bayou Casotte Dredged Material Management Site

North Alternative

The North Alternative is located north of the proposed LNG Clean Energy site and south of the proposed Casotte Landing LNG site. Under this alternative, the marine facilities would be closer to Bayou Casotte Channel, which would mean that a smaller area would need to be dredged for accessing the ship channel and less Gulf sturgeon critical habitat would be affected. However, the greater proximity to the ship channel could increase the potential for conflicts with other marine traffic and associated safety concerns. In addition, the marine facilities might need to be redesigned to fit the new configuration and excavation of onshore areas could be required to accommodate at least a portion of the ship berth, which would result in a larger facility footprint with respect to the onshore portion of the terminal. Although a wetland delineation has not been completed for the North Alternative site, based on National Wetland Inventory (NWI) data, it appears that the North Alternative would impact more wetlands than the proposed site. Because the site is farther north, the natural gas sendout pipeline would be shortened by at least 2,000 feet.

Although the North Alternative would have fewer impacts associated with dredging than the proposed site, these impacts would be relatively short term compared to the long-term impacts on wetlands and increased risks to ship safety. Therefore, this alternative does not offer a significant environmental advantage over the proposed site. Furthermore, a portion of the North Alternative site would lie within the BCDMMS and would cross a dredged material containment levee. Because the BCDMMS is an active dredged material placement area, it is unlikely to be available for use as an LNG terminal at this time. For these reasons, the North Alternative was eliminated from further consideration.

East Alternative

The East Alternative is located along Mississippi Sound east of and adjacent to the proposed LNG Clean Energy site. Because this site would be several thousand feet farther from Bayou Casotte Channel and emergent, previously placed dredged material is present in the area, we estimate that about three times more material would need to be dredged at this site to access the channel compared to the proposed site. The existing Chandeleur pipelines come onshore at this location and would need to be relocated or deepened to accommodate the access channel dredging operations. In addition, because of the more extensive dredging, a greater area of Gulf sturgeon critical habitat would be affected compared to the proposed site. NWI data indicates that nearly the entire East Alternative site is occupied by wetlands.

This location would reduce the length of the sendout natural gas pipeline by about 4,000 feet and thereby reduce the environmental impacts associated with the pipeline. However, the reduction of environmental impacts for the pipeline is small compared to the increase in impacts associated with the dredging required at the East Alternative site. Like the North Alternative, the East Alternative would lie within the BCDMMS and would cross a dredged material containment levee. For these reasons, and because it does not offer a significant environmental advantage over the proposed site, the East Alternative was eliminated from further consideration.

3.4 LNG TERMINAL DESIGN ALTERNATIVES

3.4.1 Site Configuration Alternatives

Gulf LNG evaluated two design concepts for development of the LNG terminal that would influence the site configuration. The first concept considered use of a reinforced earth dike wall for the tertiary containment area. This system would consist of a concrete-faced earthen berm with reinforcing bars anchored in the dike structure. Building this type of vertical wall structure would require construction activities on the outside of the dike area. The total area of wetlands that would be impacted under this initial design would be 11 acres.

Second, Gulf LNG considered an open-cell dike wall concept where vertical sections of interlocking sheetpile would be driven at the LNG terminal perimeter. A second sheetpile wall would be installed on the interior and the space between the two sheetpile walls would be filled with reinforced earth, forming a 25-foot-wide, 15-foot-tall vertical dike. This construction technique would set the outer limit of the LNG terminal construction activities at the sheetpile wall, and all construction activities for this portion of the project would be conducted from within the containment area. A physical barrier would thus be established for the limit of construction, and the vertical wall structure would require a smaller footprint compared to the sloped walls required for the reinforced earth dike. In the aftermath of Hurricane Katrina, the dike wall design was modified to provide additional protection to the LNG facility during severe storm events (see section 4.1.3.4). With the modifications, the dike wall would be 27 feet high and 45 feet wide.

Along with the vertical open-cell dike wall design, Gulf LNG modified the initial terminal layout to optimize space for equipment and facility areas and shifted the terminal footprint to the west. The total area of wetlands impacted by the resulting site configuration would be 3.3 acres. This is 7.7 fewer acres than would be impacted under the initial terminal layout and earthen containment dike design.

As a result, the vertical open-cell dike wall combined with the modifications to the terminal site layout was selected as the proposed final design for the LNG terminal to minimize impacts on wetlands to the maximum extent possible.

3.4.2 Vaporization Technology Alternatives

LNG must be warmed from its stored temperature of approximately -260 °F to about 50 °F before it can be transported as natural gas in the sendout pipeline. Warming LNG to a gaseous state is called vaporization (or regasification). This section describes the vaporization technology alternatives considered for the LNG Clean Energy Project and the associated environmental impacts. The following vaporization technologies were evaluated:

- SCV;
- shell and tube vaporization (STV) with gas fired heaters;
- seawater warmed vaporization; and
- ambient air heated vaporization.

Submerged Combustion Vaporizer

SCV systems are water bath structures filled with heated water. Gulf LNG would use a water bath at temperatures between 55 °F and 65 °F. Submerged within the water bath are stainless steel pipe coils. As high pressure LNG enters the vaporizing coils, the heat of the surrounding water bath is transferred through the coils to vaporize the LNG. Upon reaching the latent heat of vaporization, LNG changes to a gas and exits the coils as high pressure gas. The water bath is continuously warmed by the combustion of natural gas. Electric blowers provide combustion air at a head pressure sufficient to force the combustion gas through the water bath. As combustion gas bubbles upward through the bath, the moisture content in the gas condenses as heat is transferred to the surrounding cool water bath. This type of vaporizer has a very high thermal efficiency (up to 98 percent on a High Heating Value basis) and because of the large heat bank of the water bath, it is able to accommodate wide fluctuations in LNG vaporization rates. SCVs typically consume about 1.5 percent of the sendout natural gas from the terminal. Because the SCVs are powered by the combustion of natural gas, they produce air emissions, particularly NO_x.

Operating SCVs, the proposed LNG terminal would produce a maximum of 0.4 million gallons per day (mgd) of excess combustion and NO_x emissions control water. Disposal of the excess water requires treatment with alkaline chemicals to neutralize the acidity caused by absorbed CO_2. The air emission concentrations of NO_x would be below the allowable permit levels for the facility. SCVs are in use at existing LNG terminals at Elba Island, Georgia and Lake Charles, Louisiana. They are also approved for eventual use as part of the Cameron LNG Project located near Hackberry, Louisiana and the Sabine Pass LNG Project in Sabine Pass, Louisiana.

Shell and Tube Vaporizer with Gas Fired Heaters

STV technology involves a heat exchanger in which tubes containing LNG pass through a heat exchange medium, such as a water-glycol solution. Due to the lower thermal efficiency of the fired heaters, STVs consume slightly more sendout natural gas (1.6 percent) than SCVs (1.5 percent). STV technology uses conventional gas-fired heaters, which can be constructed with low-NO_x burner tips to reduce emissions. Further NO_x reductions are possible through the use of selective catalytic reduction technology, which cannot be applied to SCV systems.

STV vaporization technology is currently used at the existing Everett, Massachusetts; Cove Point, Maryland; and Guayanilla Bay, Puerto Rico LNG terminals.

Seawater Warmed Vaporization

Where seawater is used as the only heat source for vaporization, the process does not consume sendout natural gas and therefore does not generate significant air emissions. However, the process results in significant amounts of cool water that is discharged back to the water source. Additionally, facilities with seawater warmed vaporization frequently require a backup vaporization system. The volume of seawater required for this technology is a function of the allowable decrease in seawater temperature. If seawater temperature is above approximately 63 °F, seawater can typically serve as the sole heat source for LNG vaporization. When water temperatures drop to between 50 °F and 63 °F, supplemental heat is typically required. SCVs or STVs would be needed for maintaining operations under cool water conditions.

Seawater warmed vaporization is widely used at LNG terminal facilities internationally (e.g., Japan, Korea) and has been approved for the Port Pelican and Gulf Landing deepwater LNG ports. It has also been proposed for use in other offshore LNG projects. The NMFS has expressed significant concern

regarding the large volumes of seawater that would be required for this vaporization approach because of the large number of fish eggs and larvae that could be entrained during the process. In addition, a number of environmental groups and commercial fishing organizations have voiced strong opposition to the use of this technology.

Ambient Air-Heated Vaporizers

Under this option, ambient air-heated vaporizers, in either a natural draft or a forced draft mode, would be used to vaporize LNG. None of the sendout natural gas supply would be used, and no air emissions would be generated during the vaporization process. The ambient air-heated vaporizer system would have electricity demands similar to SCVs for equipment fans and blowers. However, the use of ambient air systems produces approximately 1.3 mgd of condensate water during operation compared to approximately 0.4 mgd for operation of SCV units. This water would be discharged to the Mississippi Sound. The ambient air-heated vaporizers operate on the basis of cooling ambient air. This could result in the formation of clouds of condensed water vapor in the vicinity of the project as a result of cooling the humid air often present in the Pascagoula area. There is no operating experience with units of the size required for regasification of 1.5 Bcfd to assess how extensive such clouds might be. Finally, the use of ambient air-heated vaporizers would require a 100 percent backup heat source (natural gas heaters) during the winter months.

Forced draft ambient air technology is proposed for the Freeport LNG terminal in Freeport, Texas and Petronet LNG in India recently began operating with ambient air-heated vaporizers. However, little operational experience is available for this technology. In addition, air temperatures are subject to rapid fluctuations and therefore, are less predictable as a vaporization source.

Vaporization Technology Alternatives Conclusions

In comparing the four vaporization technologies described above, SCV technology is the preferred alternative for the LNG Clean Energy Project based on the following rationale:

- SCV constitutes a reliable, widely used, and proven technology;
- SCVs are generally more fuel efficient than STVs;
- the application of seawater-based vaporization technologies in estuarine systems does not have regulatory agency support due to impacts on aquatic biota; and
- ambient air-heated vaporizers require 100 percent standby STV or SCV installation and have little operational experience, particularly with a facility the size of the LNG Clean Energy Project.

Although ambient air-heated vaporizers were not selected as the proposed vaporization technology for the LNG Clean Energy Project, the technology for this alternative is likely to improve in the near term. Therefore, in the terminal design, Gulf LNG has provided space and pipe interconnections that would allow the installation of a parallel ambient air system at a future date if and when the technology is proven and cost-effective for the project.

3.4.3 Electrical Power System Alternatives

Construction and operation of the proposed LNG terminal would require that electricity be provided to the site. Gulf LNG has indicated that the proposed facility would have an operating load of

approximately 24 megavolt-amps. Two alternatives are possible to meet this power requirement. First, Gulf LNG could purchase electricity from an existing public utility and second, Gulf LNG could construct an on-site electrical power generation system.

On-site power generation would reduce the need to construct some transmission lines to the terminal and provide a nominal increase in reliability. However, it would also add cost to the project and would be an additional source of NO_x emissions. For these reasons, onsite power generation was eliminated from further consideration.

Gulf LNG is proposing to purchase power from MPC and is currently working to define an appropriate route for interconnecting electric transmission lines to the LNG terminal site (see section 2.2).

3.4.4 Ship Berth Location and Configuration Alternatives

The extent of dredging that would be necessary for the ship berth and maneuvering area associated with the proposed project was established based on the minimum volumes needed to safely accommodate the largest LNG ships expected to be operating in the future during all periods of the tidal cycle. The proposed ship berth and maneuvering area would be dredged to an elevation of -42 feet MLLW, with an additional 2 feet for advance maintenance and up to 2 feet of potential overdredge allowance. The alternatives that were considered assumed this same depth, because shallower depths would not be able to fully accommodate all LNG ships and thus meet project objectives.

In an effort to reduce the dredging required for the marine facilities and minimize associated impacts, we conducted an evaluation to determine whether it would be possible to locate the ship berth in deeper water by increasing the distance between the shoreline and the jetty platform and extending the trestle in between. By placing the ship berth in deeper water, less sediment would need to be dredged. Aside from the ship channels, the water depths in the Mississippi Sound are relatively shallow and, according to maps published by the U.S. Department of Commerce, National Oceanic and Atmospheric Administration (NOAA), dredged material "spoil areas" extend south from the terminal site for approximately 2 miles. Even outside of the spoil areas, water depths of less than 10 feet extend from the shoreline to about 2 miles offshore. At about 2.5 miles south of the proposed terminal site, water depths reach a maximum of about 15 feet.

A jetty platform could not be placed within the shipping channel where the current water depth is sufficient to accommodate the proposed LNG ships because it would impact other vessel movements. Placing the platform 2.5 miles to the south of the LNG terminal site in deeper water could reduce, but would not eliminate, the amount of dredging required. Moving the platform out to this location would result in greater impacts during trestle construction (e.g., pile driving), and the trestle would interfere with boat traffic during operation of the facility. The increased distance required to transport the LNG from the ship to shore could result in lowered transfer efficiencies and increased safety considerations. Special pipe insulation would be required to prevent vaporization of the LNG over the long distance. Technology is emerging that would prevent vaporization of LNG over greater distances but it has not yet been proven in widespread commercial use. Therefore, moving the jetty platform would not be a viable alternative due to the large distance that would be required for the small increase in water depth and the corresponding reduction in dredging that would be attained.

Alternative configurations of the ship berth were also evaluated. Gulf LNG's main consideration for designing the ship berth and maneuvering area was safety for LNG ship operations while also minimizing to the extent possible the amount of dredging that would be required. Three main concepts were developed and considered for the project. These concepts are summarized in table 3.4.4-1.

TABLE 3.4.4-1 **Ship Berth Configuration Alternatives**		
Alternative	Berth Orientation Relative to Channel	Dredge Area at Toe of Slope
Concept 1	Nearly perpendicular, slight angle to south	33.3 acres
Concept 2	Nearly perpendicular, slight angle to north, small cut on opposite side of channel	31.2 acres
Concept 3	Parallel	50.8 acres

Gulf LNG presented each of these concepts to the Pascagoula Pilots at a meeting in November 2004 for review and discussion. The pilots unanimously selected Concept 1 as their preferred alternative on the basis of safe maneuvering and berthing of LNG ships. This concept was then evaluated through visual simulation studies and modified until a final design was reached. The sides of the dredged area were initially planned to slope at a ratio of 3 (horizontal) to 1 (vertical) in order to minimize the area of dredging. However, the geotechnical studies conducted for the site indicated that a 3 to 1 slope would not be stable, and a 5 to 1 slope was incorporated into the final design. The dredge area for the final design layout is approximately 37 acres at the toe of the slope, with a total dredge area at the top of the slope of 61.3 acres.

3.5 SENDOUT PIPELINE ALTERNATIVES

We evaluated alternatives for the natural gas sendout pipeline connecting the proposed LNG terminal with the existing interstate pipeline infrastructure. Gulf LNG proposes to construct about 5.0 miles of 36-inch-diameter pipeline commencing at the proposed LNG terminal and terminating at a new interconnection with the Destin pipeline system. The natural gas pipeline would also interconnect with the Gulfstream pipeline system and the BP gas processing plant at MP 4.6. The proposed route is described in section 2.1.3. Two routes were considered as alternatives to the proposed route. These route alternatives are depicted on figure 3.5-1.

Route Alternative A would follow the proposed route from the LNG terminal to about MP 3.0. At this location, Route Alternative A would continue north and west along State Highway 611 for approximately 1.1 miles where it would turn to the east for 0.3 mile. Route Alternative A would then turn due north and would follow the proposed route to its terminus at MP 5.3.

Route Alternative B would follow the proposed route from the LNG terminal along the new terminal access road corridor to about MP 1.6, where it would turn to the east, cross an existing utility corridor, and interconnect with the Destin pipeline system. All gas introduced into the Destin pipeline system at this point would be treated at the BP gas processing facility regardless of its composition.

As indicated in table 3.5-1, various criteria were considered in evaluating whether or not the route alternatives were environmentally preferable to the proposed route. These criteria included: the length of each alternative and associated amount of land disturbance for construction and permanent rights-of-way; the number of waterbodies that would be crossed by each alternative; the amount of wetlands and forested lands that would be affected; and the number of houses and high consequence areas (HCAs) in proximity to each alternative.

Route Alternative A would be approximately 1,636 feet longer than the proposed sendout pipeline route, would cross more wetlands and two additional waterbodies, and would be near more HCAs. For these reasons, this alternative was not considered environmentally preferable to the proposed route and was eliminated from further consideration.

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Figure 3.5-1 Sendout Pipeline Route Alternatives

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TABLE 3.5-1

Environmental Comparison of Alternative Pipeline Routes to the Proposed Pipeline Route

Environmental Factor		Proposed Route	Alternative A	Alternative B
Total length (feet/miles)		26,506 / 5.0	28,142 / 5.3	13,042 / 2.5
Construction right-of-way (acres) [a]		43	57	24
Additional temporary extra workspace (acres)		2.2	4	2
Route adjacent to existing rights-of-way (percent)		72	75	8
Waterbody crossings (number)		2	4	0
Wetland crossings (feet)		12,231	14,000	11,000
Forest land affected (acres) [b]		9.2	10	5.5
Known cultural resources sites (number)		0	0	0
Houses within 100 feet of the construction right-of-way (number)		0	0	0
DOT class locations: [c]	Class 1 (feet)	15,491	17,054	10,507
	Class 3 (feet)	11,035	11,035	2,534
High consequence areas (number) [d]		9	11	3

[a] Based on a construction right-of-way width of 100 feet through upland areas and 75 feet through wetlands.

[b] Includes both forested upland and wetland areas.

[c] Class 1: Location with 10 or fewer buildings intended for human occupancy.

Class 3: Location with 46 or more buildings intended for human occupancy or where the pipeline lies within 100 yards of any building, or small well-defined outside area occupied by 20 or more people on at least 5 days a week for 10 weeks in any 12 month period.

[d] High density population areas where a pipeline accident could cause considerable harm to people and their property and where an integrity management program is required to minimize the potential for an accident.

Route Alternative B would be the shortest route of those evaluated and would require about half the workspace acreage than the proposed route. No waterbodies would be crossed and the amount of wetlands crossed would be about 10 percent less than the wetlands crossed by the proposed route. Three HCAs would be located near Route Alternative B compared to nine for the proposed route. The structures within the HCAs associated with the proposed route consist mainly of parking lots and industrial shops and offices. Given that the waterbodies crossed by the proposed route are artificial structures (two canals) and the fact that the extra length of the proposed route would be through industrial land adjacent to existing rights-of-way, the additional environmental impacts from the longer proposed route would be minor. In addition, Route Alternative B would not provide Gulf LNG with the operational flexibility to bypass the BP gas processing facility should the natural gas not require processing before entering the pipeline grid. For these reasons, this alternative was eliminated from further consideration.

3.6 DREDGED MATERIAL PLACEMENT ALTERNATIVES

3.6.1 Construction Dredging Placement Alternatives

Gulf LNG would dredge about 2.96 million yd^3 of material during construction of the ship berth and maneuvering area. Gulf LNG has been working with regulatory and resource agencies to identify feasible alternatives for placing the dredged material. In June 2005, Gulf LNG prepared a conceptual report titled *Dredged Material Placement Report*, which was updated as its *Dredging and Dredged Material Placement Report* in October 2005. This report identified alternatives that were considered for dredged material placement and also discussed dredging methods. As described in section 2.4.1.3, the dredging methods are linked directly to the placement alternative, and therefore, dredging method alternatives were not analyzed independently.

The options evaluated by Gulf LNG for placement of the dredged material associated with construction fell into three categories: upland confined placement, offshore placement, and beneficial use. The potential dredged material placement alternatives evaluated are summarized in table 3.6.1-1 and discussed below.

TABLE 3.6.1-1

Potential Dredged Material Placement Alternatives [a]

Alternative	Limited to Sand	Gulf Sturgeon Critical Habitat	Long-Term Maintenance/ Monitoring	Limited Capacity	Other Constraint
Upland Confined Placement	no	no	no	no	No suitable property/pipeline route
Offshore Placement					
Littoral Zone	yes	yes	no	no	Restricted to maintenance dredged material
ODMDS	no	no	no	no	no
Beneficial Use					
Grand Batture Islands	no	yes	yes	no	In Grand Bay National Estuarine Research Reserve
Round Island	yes	yes	no	yes	Rock breakwater likely required
Greenwood Island	yes	yes	no	yes	Material not needed
COE BCDMMS Mitigation Area	yes	yes	no	yes	Material not needed
Pascagoula Beach	yes	yes	no	yes	Rock breakwater likely required
Geotextile Tube	yes	yes	no	yes	Potential schedule conflicts
South Placement Area — 3-foot contour	no	yes	yes	yes	no
South Placement Area — 4-foot contour	no	yes	yes	no	no

[a] COE and other agency (depending on specific alternative) approval would be required for all alternatives.

COE U.S. Army Corps of Engineers

ODMDS Ocean Dredged Material Disposal Site

BCDMMS Bayou Casotte Dredged Material Management Site

3.6.1.1 Upland Confined Placement

When the Bayou Casotte Channel was widened and deepened in 2002, the COE developed a document titled, *Dredged Material Management Plan for the Bayou Casotte Channel and Inner Harbor* (DMMP). The DMMP included an extensive search and evaluation of potential upland confined placement alternatives for dredged materials originating from the Bayou Casotte Channel area. The COE report determined that only two viable options existed at that time. The first was a site about 90 acres in size at the former airport location north of the proposed LNG terminal site and the second was the 136-acre site now established as the BCDMMS. Since the release of the DMMP, the 90-acre airport site has been subdivided and sold as industrial development parcels, collectively referred to as the Stennis Industrial Park. Therefore, this site is no longer feasible as an upland confined dredged material placement area. The DMMP stipulated that the BCDMMS site was to be reserved for material derived from maintenance dredging only, and recent consultations with the COE have confirmed that dredged material from construction of the LNG Clean Energy Project would not be allowed in the BCDMMS placement area. Therefore, the BCDMMS was ruled out as an alternative for upland confined placement of the dredged material generated during project construction.

Gulf LNG recently conducted additional property searches for potential upland placement areas with a focus on properties of sufficient size (approximately 150 to 250 acres) within 5 to 10 miles of the LNG project area. Potential locations would also require that relatively unobstructed pipeline routes be available for the dredged materials to be pumped to the site and for the excess waters to be drained back to Mississippi Sound. One property was found that met the size and distance requirements but did not meet the pipeline requirements because the pipeline route would have been through urban development in Pascagoula. As a result, the alternative of upland confined placement of the dredged materials associated with construction of the LNG Clean Energy Project was eliminated from further consideration.

3.6.1.2 Offshore Placement

Gulf LNG considered two alternatives for placement of dredged material offshore in the Gulf of Mexico: 1) a littoral zone area located approximately 1 mile southeast of Horn Island and 2) the EPA-designated ODMDS located approximately 5 miles south of Horn Island (see figure 3.6.1-1). These placement areas were used by the COE for disposal of the approximately 11.5 million yd^3 of material dredged from the Bayou Casotte Channel and other channels in the area during 2002. Offshore dredged material placement would require permits and approval from the COE and the EPA, which would be contingent, in part, on the material passing laboratory testing for contaminants. Offshore placement would require using mechanical dredges to place the sediments on barges or scows for long-distance transport to the placement area.

The littoral zone placement area southeast of Horn Island is located in water at a depth of about 15 to 30 feet. Only dredged material with a predominance of clean sand could be placed in this area. Based on sampling of the sediments to be dredged for the project, layers consisting primarily of sand are present (see section 4.2.2). However, the sandy material would have to be segregated from finer grained material during the dredging process, adding time and expense to the dredging project. Because two-thirds of the littoral zone placement area lies within designated critical habitat of the Gulf sturgeon, the use of that portion of the littoral zone placement area could result in additional impacts on this endangered species. Finally, the COE has indicated that this placement area is currently restricted to material from maintenance dredging of the Pascagoula Bar Channel and the Horn Island Pass Channel. Therefore, this alternative was eliminated from further consideration.

The ODMDS south of Horn Island in the Gulf of Mexico has historically been used for new dredge work and maintenance dredging in the Pascagoula area. The ODMDS is restricted to placement of dredged material from the Mississippi Sound. Water depths at the ODMDS range from 38 to 52 feet and average 46 feet, and the area is 18.5 square nautical miles in size (EPA, 2005a). The ODMDS is located in deeper water and is farther from the LNG Clean Energy Project area compared to the littoral zone placement area. However, the ODMDS would not have constraints relative to the grain size of the dredged material that could be placed, nor is it located within designated Gulf sturgeon critical habitat. Therefore, the ODMDS is the preferred offshore placement alternative and is the proposed placement alternative for the dredged material associated with construction of the project.

3.6.1.3 Beneficial Use

For guidance in identifying potential beneficial uses of the dredged materials from the LNG Clean Energy Project, Gulf LNG consulted with COE staff and reviewed the COE Mobile District's report, *Long-Term Comprehensive Master Plan for Beneficial Uses of Dredged Material along Coastal Mississippi* (COE Master Plan), dated September 17, 2002. As described below, a number of beneficial use alternatives were considered. Each of these alternatives would use hydraulic cutterhead dredging technology. The location of each alternative is shown on figure 3.6.1-1.

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Figure 3.6.1-1 Offshore and Beneficial Use Dredged Material Placement Alternatives

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Grande Batture Islands

This open water site is located 4 to 6 miles east of the proposed LNG terminal and is included in the COE Master Plan. Over the past 30 to 40 years, erosion has caused the Grande Batture Islands to become submerged, resulting in significant loss of wetlands, additional erosion of once protected shoreline to the north, and saltwater intrusion into areas that were at one time significant producers of oysters. The intent of a beneficial use project in this area would be to restore the wetlands and to reduce saltwater intrusion so that the oyster reefs may return to productivity. Gulf LNG prepared a conceptual beneficial use plan for the Grande Batture Islands that would accommodate the full amount of material dredged for the project (2.96 million yd^3). A hydraulic cutterhead pipeline dredge unit would be used to pump the materials directly to the site. The dredged material would be placed in approximately 10 feet of water with a rock breakwater placed on the offshore side to help contain the sediments and protect them from potentially erosive wave action. The placement area would be approximately 7,500 feet long and 250 feet wide. The total footprint would be approximately 375 acres, of which approximately 95 acres would be emergent. Long-term monitoring and maintenance would be required to ensure the integrity of the rock breakwater and that the created wetland habitat performs as intended.

The Grande Batture Islands are located within Gulf sturgeon critical habitat. For that reason, the NMFS expressed concern that this placement option would adversely affect this endangered species. In addition, the MDMR did not support the alternative because it would be located within the Grand Bay National Estuarine Research Reserve. Consequently, the Grande Batture Islands beneficial use alternative was eliminated from further consideration.

Round Island

Round Island is located approximately 4.5 miles southwest of the proposed LNG terminal site in Gulf sturgeon critical habitat. The remains of a historic lighthouse are located near the southern end of the island. Due to beach erosion, the shoreline has been moving closer to the historical site. The COE and the City of Pascagoula have considered beneficial beach replenishment plans at this location in the past. According to the COE, 100,000 to 200,000 yd^3 of sand would be needed for this beneficial use alternative. The sediment would be dredged using hydraulic cutterhead equipment and transported by pipeline to the placement site. Several factors make this alternative impractical. First, it could accommodate only a small portion (3 to 7 percent) of the total volume of material that would be dredged as part of the LNG Clean Energy Project. One or more additional placement areas would be necessary, and depending on the area(s) used, costly mobilization of multiple types of dredging equipment would likely be necessary. Second, although the materials to be dredged include some sand strata, they are relatively dispersed in clay, and segregation would add time and expense to the project. Finally, since the beach area is erosional, a rock breakwater would likely be required for containment. These last two factors limit the economic feasibility of using Round Island for dredged material placement associated with the proposed project. Therefore, the Round Island beneficial use alternative was eliminated from further consideration.

Greenwood Island Mitigation Area

The Greenwood Island Mitigation Area is located approximately 1 mile northwest of the project site on the opposite side of Bayou Casotte Channel. This wetland mitigation area covers approximately 18 acres and is within Gulf sturgeon critical habitat. The capacity of this alternative is severely restricted because of the limited size of the mitigation area. It would only be able to accommodate about 5 percent of the total volume of material requiring placement for the LNG Clean Energy Project. Furthermore, based on discussions with the COE, Gulf LNG determined that the COE did not require any additional material for this project. For these reasons, this alternative was eliminated from further consideration.

COE BCDMMS Mitigation Area

The COE BCDMMS Mitigation Area is located adjacent to the proposed LNG terminal site within Gulf sturgeon critical habitat. The mitigation area consists of created wetlands and covers approximately 24 acres and would only be able to accommodate about 3 percent of the total volume of material requiring placement for the LNG Clean Energy Project. As with the Greenwood Island Mitigation Area, the COE indicated that additional material was not needed for this project. Therefore, this alternative was eliminated from further consideration.

Pascagoula Beach (Between Greenwood Island and the Pascagoula River)

This potential beach replenishment site is located at the southern shoreline of the City of Pascagoula, approximately 1.5 miles northwest of the project site. This location is within Gulf sturgeon critical habitat. The beach area has recently been a concern for the Jackson County Board of Supervisors due to shoreline erosion. A hydraulic cutterhead pipeline dredge unit would be used to transport sandy dredged material to the beach area from the project site. This option has the advantage of being relatively close to the project site. However, as discussed for previous alternatives, the alternative is impractical because only sandy material could be used and only a small portion of the total volume of dredged material (i.e., 5 to 10 percent) could be accommodated. In addition, a rock breakwater would likely be necessary for containment, which would limit the economic feasibility of this alternative. Therefore, this beach replenishment alternative was eliminated from further consideration.

Sand Source for COE Geotextile Tube Use

Gulf LNG considered whether dredged material from the LNG Clean Energy Project could be used for a COE project currently in the planning stage that would consist of filling geotubes with sandy materials. The geotubes would be placed in a line running south from Singing River Island along the western edge of the Upper Pascagoula Channel, 3 to 4 miles west of the proposed LNG terminal site. The COE estimates that between 200,000 and 400,000 yd^3 of material would be needed. Because only sandy material could be used in the geotextile tubes, only a fraction of the total volume could be used for this alternative. Additionally, the timing of the COE project might not coincide with the LNG Clean Energy Project. For these reasons, this alternative was eliminated from further consideration.

South Placement Area

At the recommendation of the MDMR, Gulf LNG prepared a conceptual plan to place dredged material adjacent to the shoreline south and east of the project site in what would be an extension of the BCDMMS Mitigation Area. This area has been undergoing shoreline erosion, and the placement of dredged material from the project would mitigate this erosion by creating new coastal wetlands. In addition, the beneficial use area would serve as mitigation to compensate for the loss of wetlands at the proposed terminal site.

Under this alternative, the dredged material would be placed either up to the 3-foot offshore depth contour (covering 415 acres) to accommodate half of the total volume of dredged material or up to the 4-foot depth contour (covering 525 acres) to accommodate the full volume of dredged material. A rock breakwater would be constructed at the perimeter of the South Placement Area (either at the 3- or 4-foot contour) to contain the dredged material. Materials dredged from the ship berth and maneuvering area would then be used to fill the area within the perimeter rock breakwater. After all of the dredged materials have been placed, Gulf LNG would recontour the beneficial use site (e.g., creating terraces and internal channels) and plant seagrasses and wetland vegetation. Breaks in the outer perimeter would be added to allow water circulation within the placement area.

Because the proposed South Placement Area is within designated Gulf sturgeon critical habitat, the use of this alternative could potentially adversely affect this endangered species. As previously indicated, the 3-foot contour scenario would accommodate only half of the dredged material generated by the project, potentially resulting in the need for more than one type of dredging equipment. Long-term monitoring and maintenance would also be required to ensure the integrity of the rock breakwater and that the created wetland habitat performs as intended. Gulf LNG states that the requirement for maintaining the wetlands in perpetuity, without an established cost-sharing partner, makes this alternative economically infeasible when compared with other environmentally acceptable alternatives. For this reason, and because of the potential adverse impacts on the Gulf sturgeon, the South Placement Area was eliminated from further consideration.

3.6.2 Maintenance Dredging Placement Alternatives

Gulf LNG anticipates that the ship berth and maneuvering area would require periodic maintenance dredging. Based on estimated shoaling rates in the area, Gulf LNG estimates that between 115,000 to 180,000 yd^3 of material would need to be removed from the ship berth and maneuvering area every 3 years. The ship berth and maneuvering area would be owned by the JCPA after it is constructed and the JCPA would be responsible for the maintenance dredging.

There are currently no reasonable beneficial use alternatives that could be relied upon for long-term periodic placement of maintenance dredged material associated with the LNG Clean Energy Project. Therefore, beneficial use alternatives were not considered for maintenance dredged material placement. The only viable alternatives would be the ODMDS and the BCDMMS. Although the ODMDS is the preferred placement alternative for construction of the marine facilities, it would be cost prohibitive to consider its long-term use for the placement of maintenance material, primarily because of the long haul distance involved for the relatively small quantities of material generated every 3 years.

The BCDMMS is approximately 136 acres in size, with a perimeter containment dike and a drainage structure located at the southeast corner. Hydraulic cutterhead dredging technology would be employed for this placement alternative. The BCDMMS was created to accommodate maintenance dredged material from the Bayou Casotte Channel and the facilities located within the Bayou Casotte Harbor. Therefore, Gulf LNG states that it is an appropriate placement area for the maintenance dredged material associated with the LNG Clean Energy Project. Assuming the largest of reasonably expected shoaling rates, Gulf LNG calculated that the addition of this material to the BCDMMS would reduce its projected useful life from 50 years to approximately 39 years, if no changes were made to the BCDMMS management program. Appropriate revisions to the cost-sharing agreement between the JCPA and the COE may be necessary to accommodate the additional material placed in the BCDMMS.

3.6.3 Conclusions Regarding Dredged Material Placement Alternatives

Taking into consideration a variety of factors, including Gulf sturgeon critical habitat, capacity, grain size restrictions, economic feasibility, and long-term maintenance needs, the ODMDS was determined to be the preferred dredged material placement alternative for the material generated during construction of the LNG Clean Energy Project. As discussed in section 3.6.1.2, offshore dredged material placement would require permits and approval from the COE and EPA. Section 103 of the MPRSA regulates the placement of dredged material in the ocean. As part of the analysis of dredged material placement alternatives, Gulf LNG prepared a draft section 103 evaluation to confirm the suitability of the dredged materials for offshore disposal. The results of the evaluation are discussed in section 4.2.2.

The BCDMMS would be the most appropriate placement area for dredged material generated during maintenance dredging.